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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : A47L 15/48 — A1

(11) International Publication Number: **WO 98/33427**

(43) International Publication Date: 6 August 1998 (06.08.98)

(21) International Application Number: PCT/TR98/00003

(22) International Filing Date: 3 February 1998 (03.02.98)

(30) Priority Data:
97/00082 3 February 1997 (03.02.97) TR

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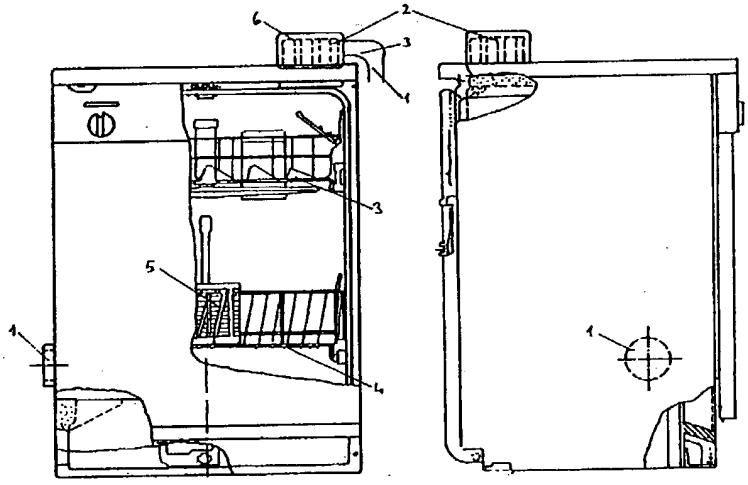
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: A DISH–WASHER WHEREIN THE HUMIDITY CONTROL IS MADE BY A TEMPERATURE SENSOR



(57) Abstract

The present invention is related to a dish–washer wherein a dryer fan is used in order to dry such objects as dishes, glasses, etc., after being washed and the humidity control is made by using a temperature sensor, for an improved drying process. A temperature sensor (8) placed in the fan channel (7) used to discharge air from the wash machine tub during the drying cycle, gives information about the dryness of the objects within the machine by determining the changes in the temperature of air inside the channel. With the dish washing machine of the present invention wherein a method based on the fact that an increase in the temperature shows the degree of dryness of the objects inside the machine, is used, hence the need to use a humidity sensor for the control of dryness is eliminated and to use a temperature sensor which is a cheaper method, is proposed.

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A DISH-WASHER WHEREIN THE HUMIDITY CONTROL IS MADE BY A TEMPERATURE SENSOR

The present invention is related to a dish-washing machine wherein a drying fan and a temperature measuring unit for an improved drying performance are used for the washing and drying of such objects as dishes, cutlery, etc.

The drying capacity of the dish washers together with their washing performance is an important parameter. In a washing cycle, the dish washer completes the main washing operation and then starts drying.

Drying of the washed dishes is realized by different ways. One way is to provide drying by increasing the temperature using a heater present in the tub, during the drying cycle. As this method does not remove the humidity in the tub, and provides a drying effect by increasing the temperature and thus reduces the relative humidity in the air, when the door is opened and therefore the inner temperature is reduced, it leads to an excessive condensation which is an undesired condition with regard to user's comfort.

There are several methods to increase the drying effectiveness of such a system. The most common of them is using a cold surface to provide the condensation of the humid air within the dish-washer. This cold surface is provided by reducing the temperature of one of the walls by using a water tank (US Patents No.s 3.65.8.075 and 3.704.170). Another method is using a system that moves the air

for example by a fan. In the US patent No 3 026 628, a blow-in system providing the air heated outside to be introduced into the washing section, is disclosed.

Whereas, in the US Patent No. 3.378.933, an electrical valve placed at the inlet of the blower, is used to control the air flow within the blower. In US Patent No. 4.247.158, a similar system consisting of an air inlet opening located at the lower wall of the washing compartment (tub) and a blower sending the external air into the said compartment. This invention also proposes to place valves at the inlet and outlet of the air flow; the valves close by gravity when the blower stops.

Another method is to reduce the interior humidity by discharging the hot air to outside. In this case, the drying operation is realized by taking the hot and humid air directly out of the dish washer tub and thus by removing relative humidity and as well as absolute humidity. This system also eliminates the excessive condensation problem upon opening the door and provides less energy consumption as compared with conventional systems.

In some systems, the hot and humid inner air is removed by a fan placed at the door region. In the US patent No. 3.908.681 it is declared that drying performance is improved by placing a fan that removes air, at the lower part of the washing compartment. The problem of all these systems, regardless the location of the fan is, to determine the dryness of the objects in the dish washer and to control the operational duration of the fan in order to finalize the drying cycle. Currently, in all models with fan, the fan operates all through a pre-determined period without controlling the dryness of the objects in the dish washer.

In general practise, the operation of the fan is controlled by a humidity sensor used to determine dryness. However some problems arise with this practice The most important of these problems is the fact that the humidity sensor is not simple and practical. Most of these devices respond very slowly and are not

accurate in environments with high condensation. Therefore under the conditions present inside the dish washer, measurement of humidity is quite difficult and generally require costly solutions. Furthermore the measurements taken, give information about the humidity condition at the point where the sensor has made the measurement, instead of giving an average value.

The object of the present invention is to realize a dish washer having a fan-drier system in which a fan is placed on the ceiling of the tub, at a location diagonal to the air inlet and wherein a control method is applied for operating the drier fan.

The dishwasher realized to achieve these objects of the present invention is described below, also by making references to the attached drawings, wherein:

Figure 1 is the schematic view of the dish washer

Figures 2,3,4 -show the change of temperature in the dishwasher tub during fan drying cycle.

In the lower part of the left wall of the dish washer tub (Fig. 1) near the front door, there is an air inlet opening (1). The fan (2) is placed on the ceiling, at the right rear corner. Thus the path of the air from the inlet to the outlet passes through the upper and lower baskets (3) and (4) and the cutlery basket. This air flow path increases the drying effectiveness of the machine Fan (2) is installed in an enclosure that works as an air collector and directs the air flow from the fan (2) towards the discharge channel (7).

The fan discharging the air is placed on the ceiling (Fig.1) diagonally to the air inlet opening (1), thus the passage way of the air entering the tub is elongated. According to the calculations, this arrangement forms vertices in such a manner that they enhance the drying process. In addition , it has been observed that the

air discharged from the tub by means of a fan (2) represents the inner atmosphere very well, with regard to temperature and humidity.

The drying fan (2) consists of a blower type rotor and an air discharge duct (7) located at the outlet side of the rotor. Hot and humid air from the mid-region enters the fan and is discharged through the air discharge duct (7). A temperature sensor (8) placed at this location measures the temperature changes of the exiting air.

As mentioned above, discharged air has the average characteristics of the air inside the machine and it is replaced by cold air entering through the inlet opening (1) existing on the side wall, near the bottom. Due to the difference of density, cold air sinks to the bottom, then changes the direction and rises upwards and is discharged from the ceiling by means of a fan This arrangement, lengthens the path of the air and increases its drying capacity. The operation of the fan (2) is controlled by means of a thermometer (8).

In this dish washer realized according to the invention, the temperature of the inside air is measured instead of the dryness of the dishes etc. in the machine, in order to determine the dryness of its contents.

Following the main washing cycle, fan (2) starts to discharge the hot and humid air. During this period, due to the cold air replacing the hot and humid air, the interior temperature decreases. This continuos decrease in the temperature of the inner air and of the walls can easily be seen from the measurements (Figures 2 and 3).

After a certain time the temperature starts to increase due to the machine load and environmental conditions; although discharge of hot air and intake of cold air is carried on. The reason for this is the fact that water accumulated on the dishes is

completely removed and these objects start to heat the air due to their thermal inertia.

This is also verified by using a sensor developed specifically to control the dryness of the surfaces of dishes etc., which operates according to the principle of electrical conductance.

The temperature measures taken from the surface of a dish in the dishwasher show that the air temperature value increases up to the dish temperature value (Figure 3).

Based on these results the dryness of the objects washed in a dishwasher, may be determined by monitoring the changes in the temperature of the air discharged by the fan. Said increase in temperature may be up to 10°C in a short duration . This increase in temperature is observed at different parts of the machine tub at different times. The most typical location giving the average air temperature value is observed to be the interior of the air discharge duct (7). This increase in temperature is used to control the operation of the fan in order to end the drying cycle.

The temperature sensor (8) placed in the air discharge duct (7) used for removing air from the dishwasher tub during drying process, measures the changes in the air temperature. An increase in the temperature is evaluated as an indication of the dryness of the contents of the dish washer. Therefore, the present invention eliminates the requirement to use a humidity sensor for dryness control and provides control method for the operation of the fan.

CLAIMS

1) Dish-washer wherein the humidity control is made by a temperature sensor and drying is realized by discharging the air inside a closed dish washer tub, by means of an air removing arrangement, said tub having an air inlet hole and an air discharge hole and containing such objects to be dried as dishes etc. that have a relatively high thermal capacity, characterized in that the operation of the air discharge mechanism is controlled by measuring the changes in the temperature of the discharged air by a temperature sensor in order to complete the drying cycle, and the humidity of the contents of the dishwasher is also controlled by the same temperature sensor.

2) A dish-washer according to claim 1, characterized in that the air inlet opening and the air discharge mechanism are located as far from each other as possible in order to lengthen the path of the air taken in the tub and to form vortices so that they accelerate the drying process.

3) A dish washer according to claims 1 and 2, characterized in that the air inlet opening is located at the lower section of the left wall of the tub, near the bottom and the air discharge system is located on the right back part of the ceiling.

4) A dish washer according to claims 1 to 3, characterized in that, humidity is controlled by temperature sensor with an air discharge system wherein a fan consisting of an air discharge duct through which the discharged air passes, is used.

5. A dish washer according to claims 1 to 4, characterized in that the temperature sensor is placed inside the air discharge duct.

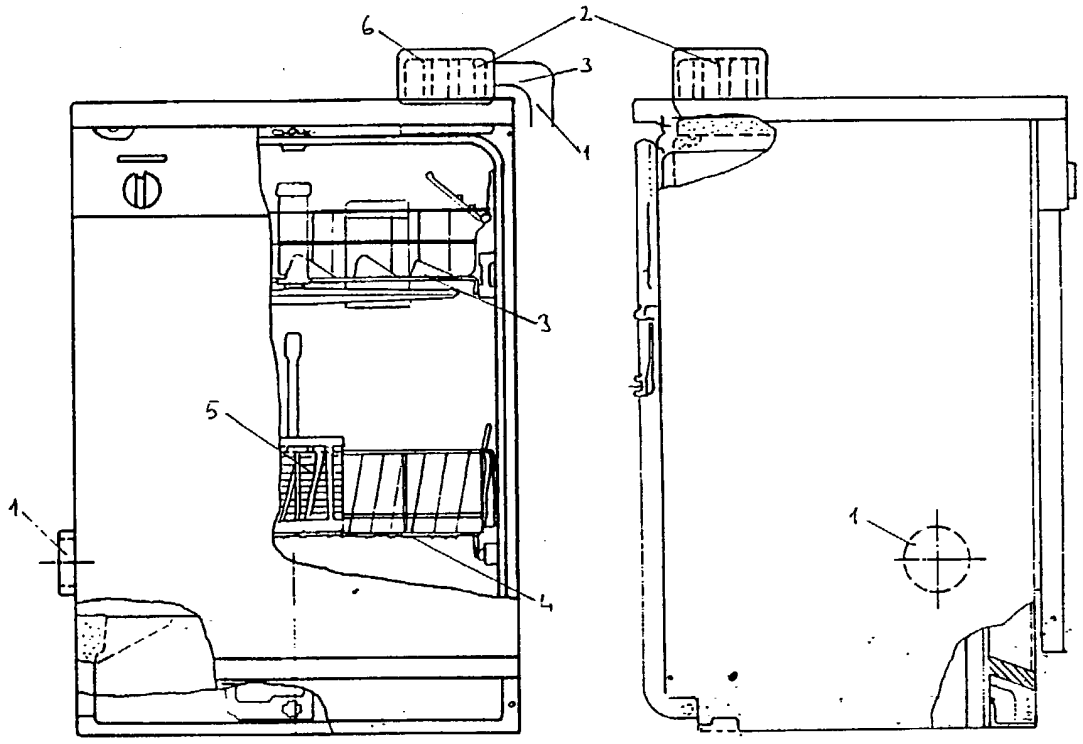

FIGURE 1

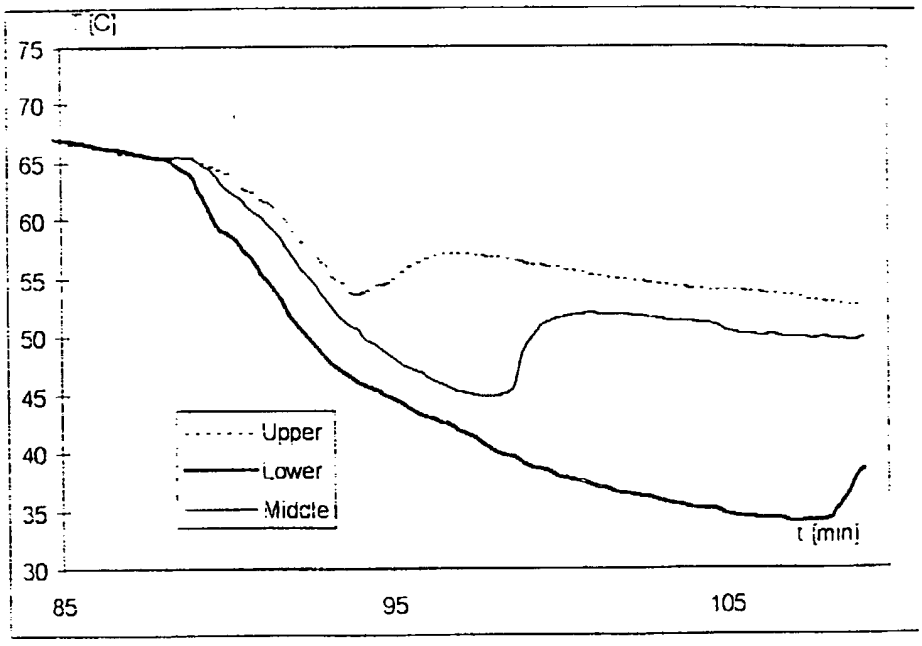

Figure 2

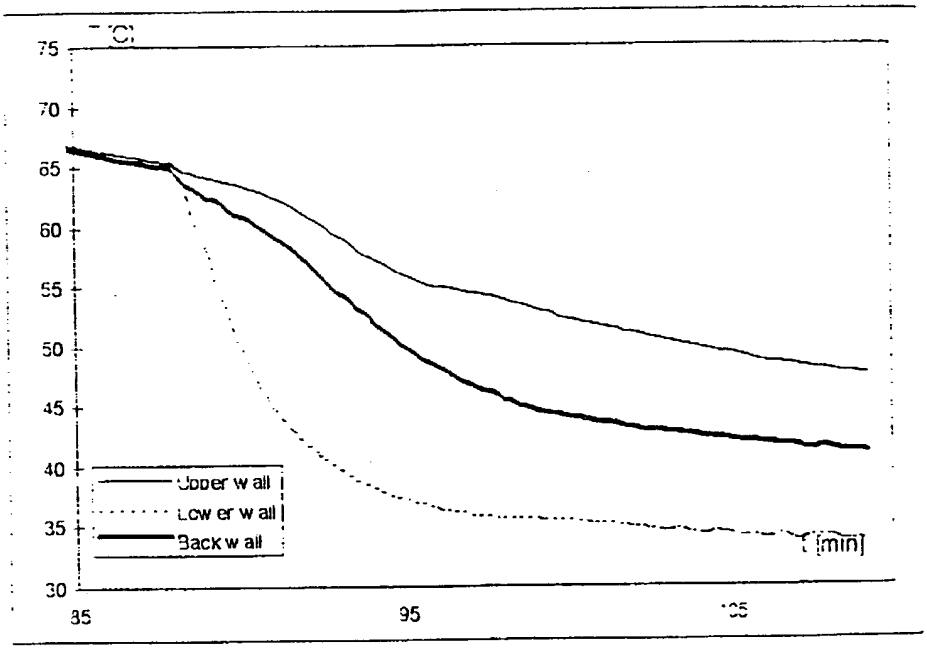
°C
75
70
65
60
55
50
45
40
35
30
Upper wall
Lower wall
Back wall
t [min]
85
95
105

Figure 3

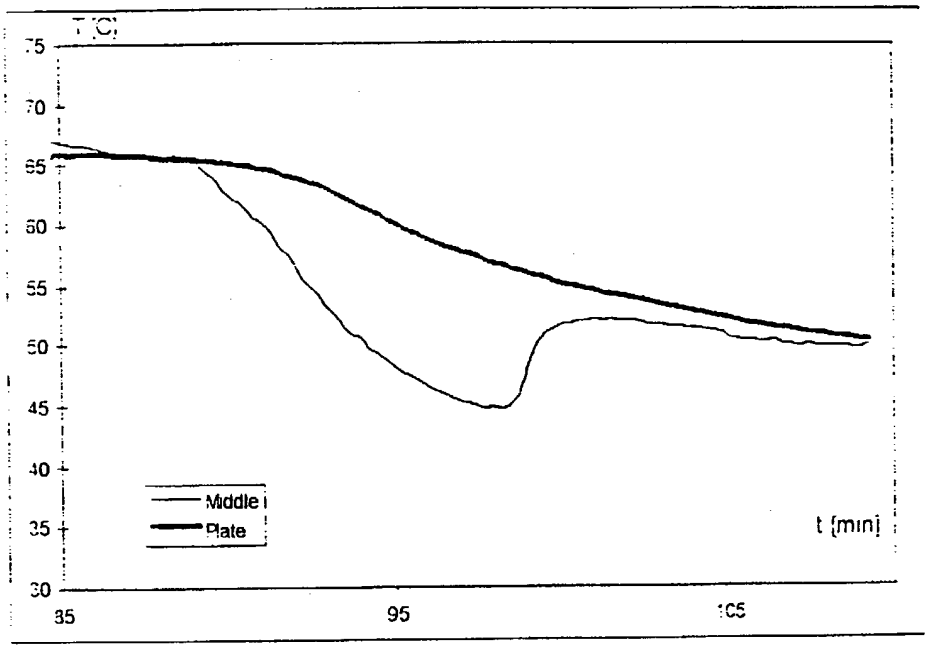

Figure 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/TR 98/00003

A. CLASSIFICATION OF SUBJECT MATTER

IPC[6]: A 47L 15/48

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC[6]: A 47 L 15/42 - 15/48

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 3 126 024 A (JELLIES) 24 March 1964 (24.03.64), fig. 2, pos. 81.	1-3,5 4
A	US 3 397 708 A (BRADEN) 20 August 1968 (20.08.68), fig. 5, pos. 142.	1-5
A	DE 2 101 746 A (MIELE) 15 March 1973 (15.03.73), claims.	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search	Date of mailing of the international search report
12 May 1998 (12.05.98)	26 May 1998 (26.05.98)
Name and mailing address of the ISA/ AT AUSTRIAN PATENT OFFICE Kohlmarkt 8-10 A-1014 Vienna Facsimile No. 1/53424/535	Authorized officer Bencze Telephone No. 1/53424/373

Form PCT/ISA/210 (second sheet) (July 1992)

The documents cited in the search report relate to dishwashing apparatuses with a blower and a temperature responsive means to sense the temperature of the air circuit (see especially US 3 126 024 A, column 6, lines 32-52!) so as to initiate drying air circulation through the chamber after a predetermined temperature has been reached.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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Im Recherchenbericht angeführtes Patentdokument Patent document cited in search report Document de brevet cité dans le rapport de recherche	Datum der Veröffentlichung Publication date Date de publication	Mitglied(er) der Patentfamilie Patent family member(s) Membre(s) de la famille de brevets	Datum der Veröffentlichung Publication date Date de publication
US A 3126024		keine - none - rien	
US A 3397708	20-08-68	keine - none - rien	
DE A 2101746		DE A1 2101746	15-03-73
		IT A 957086	10-10-73
		DE U 7046996	31-05-72
		FR A3 2117860	28-07-72
		FR A5 2117860	28-07-72
		FR B3 2117860	21-06-74